TURBOCHARGER, G-CHARGER

CHARGE AIR PRESSURE WITH TURBOCHARGER

Turbocharger system components, removing and installing

Observe rules for cleanliness. See **RULES FOR CLEANLINESS** .

NOTE:

- **All hose connections are secured with clips.**
- **Charge air pressure must be leak free.**
- **Replace self-locking nuts.**

NOTE: The following list refers to items in Fig. 1 .

1. **Exhaust manifold**
   - With turbocharger
   - Only replace as assembly
2. **Intake manifold**
3. **from charge air cooler**
4. **Gasket**
   - Replace
   - Coating (beading) toward intake manifold
5. **25 N.m (18 ft lb)**
6. **Gasket**
   - Note installation position
7. **Bracket**
   - For heat shield (item -9-)
8. **Washer**
9. **Heat shield**
   - Engage in bracket (item -7-)
10. **Turbocharger**
    - Only replace as assembly
    - Removing: remove right drive shaft at transmission:

      See **FRONT AXLE SHAFT** .

- Charge air pressure control, checking. See **CHARGE AIR PRESSURE SYSTEM, CHECKING** .

11. **Pressure unit**
    - For charge air pressure control valve
    - Integral part of turbocharger; cannot be replaced
12. **From Air Cleaner**
13. **Gasket**
    - Replace
14. **Sealing ring**
    - Replace
15. **Oil return pipe**
    - To cylinder block
16. **Banjo bolt**
    - 25 N.m (18 ft lb)
17. **15 N.m (11 ft lb)**
18. **40 N.m (30 ft lb)**
19. **Bracket**
20. **25 N.m (18 ft lb)**
21. **Gasket**
    - Replace
22. **Front exhaust pipe**
23. **Connection**
24. **10 N.m (7 ft lb)**
25. **Oil supply pipe**

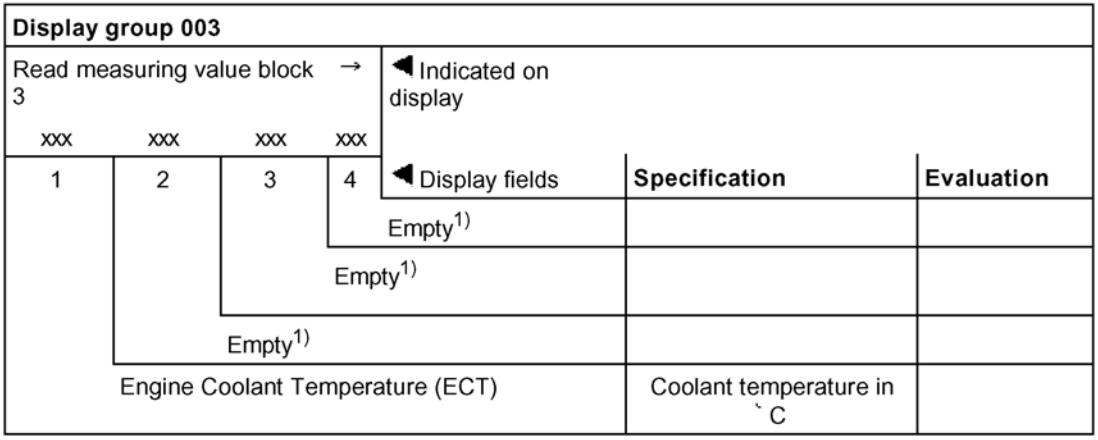

Fig. 1: Exploded View Of Turbocharger System Components
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Charge air cooler components, removing and installing

NOTE:

- **All hose connections are secured by clips.**
- **Charge air pressure must be free of leaks.**

NOTE: The following list refers to items in Fig. 2 .

1. **Charge air cooler**
2. **10 N.m (7 ft lb)**
3. **Connecting hose**
4. **Connecting pipe**
   - Charge air cooler/intake manifold
   - Lower pipe
5. **Connecting hose**
6. **Connecting pipe**
   - Charge air cooler/intake manifold
   - Upper pipe
7. **O-ring**
   - Replace if damaged
8. **Intake Air Temperature sensor -G72-**
9. **5 N.m (3.7 ft lb)**
10. **Connecting hose**

- Charge air cooler/intake manifold

11. **Connecting hose**
    - Charge air cooler/turbocharger
12. **Charge air cooler**
13. **Bracket**

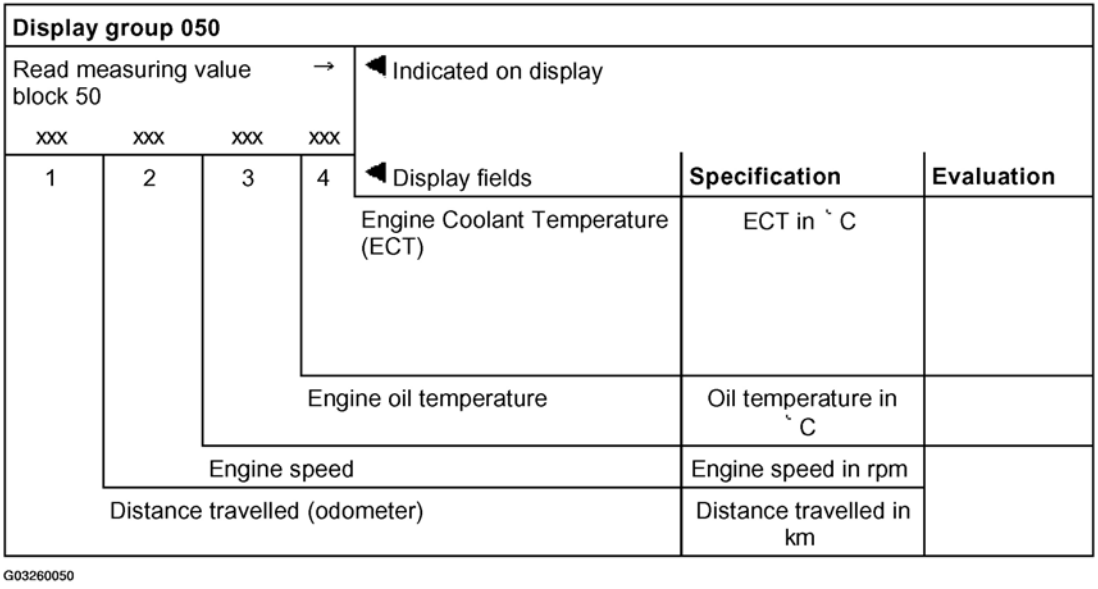

Fig. 2: Exploded View Of Charge Air Cooler Components
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Turbocharger, hose and pipe connections

Vacuum hose diagram

NOTE: The following list refers to items in Fig. 3 .

1. Solenoid valve for Wastegate Bypass regulator valve -N75-
2. to EGR vacuum regulator solenoid valve -N18-
3. to air filter
4. Vacuum reservoir
5. Reservoir for wastegate
6. Turbocharger
7. to Intake Manifold Change-over valve -N239-
8. Return valve, with connection points to Wastegate Bypass regulator valve -N75-.

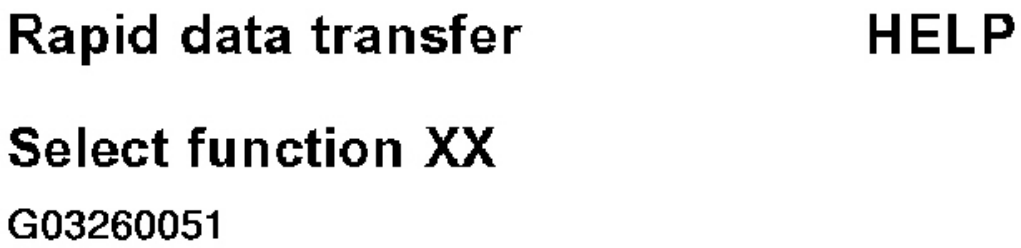

Fig. 3: Exploded View Of Turbocharger, Hose And Pipe Connections
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Rules for cleanliness

When working on the turbocharger and charge air pressure, pay careful attention to the following rules:

- Thoroughly clean all unions and the adjacent areas before disconnecting.
- Place parts that have been removed on a clean surface and cover over. Do not use fluffy cloths!
- Carefully cover opened components or seal, if the repair cannot be carried out immediately.
- Only install clean components: Only unpack replacement parts immediately prior to installation. Do not use parts that have been stored loose (e.g. in tool boxes etc.).
- When the system is open: Do not work with compressed air if it can be avoided. Do not move vehicle unless absolutely necessary.

CHARGE AIR PRESSURE SYSTEM, CHECKING

Special tools and equipment

- VAG 1390 Vacuum pump
- Fluke 83 Multimeter
- VW 1594 Adaptor kit
- VAG 1598/22 Test box
- VAG 1551/1552 with VAG 1551/3 adaptor cable
- Wiring diagram

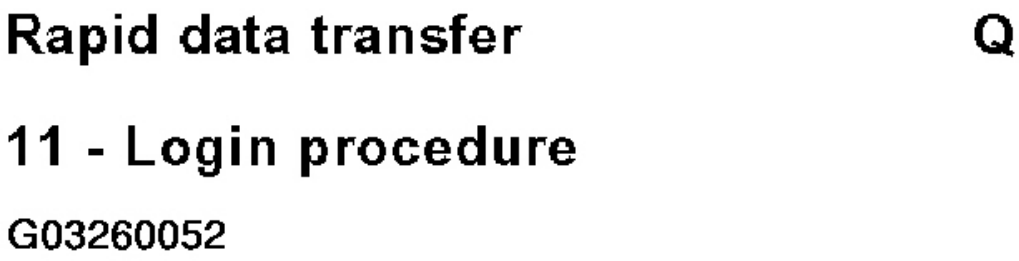

Fig. 4: Identifying Special Tools And Equipment
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Checking conditions

- No DTCs stored in Diagnostic Trouble Code memory

  See DTC Memory, Checking .

- No leaks from intake and exhaust systems.
- No stored DTCs from engine and fuel injection system, e.g. start of injection, fuel injectors and compression pressure.
- Engine oil temperature 80°C minimum.

Test sequence

Observe following if test and measuring instruments are required during a test drive:

- Test and measuring instruments must be secured to the rear seat and operated by a 2nd person from this location.

  CAUTION: If test and measuring instruments are operated from the front passenger seat and the vehicle is involved in an accident, there is a possibility that the person sitting in this seat could receive serious injuries when the airbag is triggered.

- Connect VAG 1551/1552 Scan Tool

  See VAG1551/1552 Scan Tool, Connecting .

- Start engine and let idle
- Press 0 and 1 buttons to select Address word 01 "Engine electronics"

Display will appear as shown in **Fig. 5** .

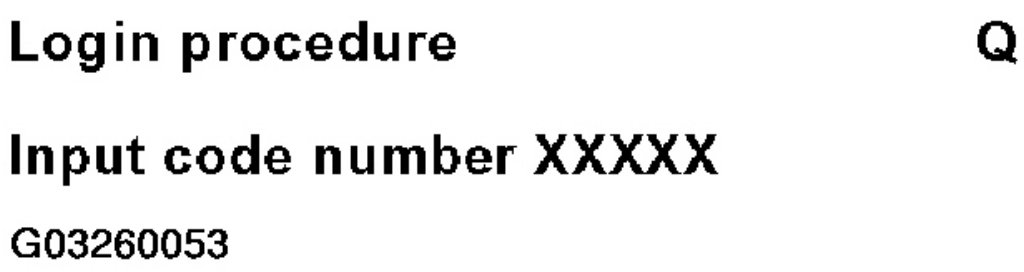

Fig. 5: Identifying VAG 1551/1552 Scan Tool Display (1 Of 3)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Press 0 and 8 buttons to select Function 08: "Read measuring value block"
- Press Q button to enter input

Display will appear as shown in **Fig. 6** .

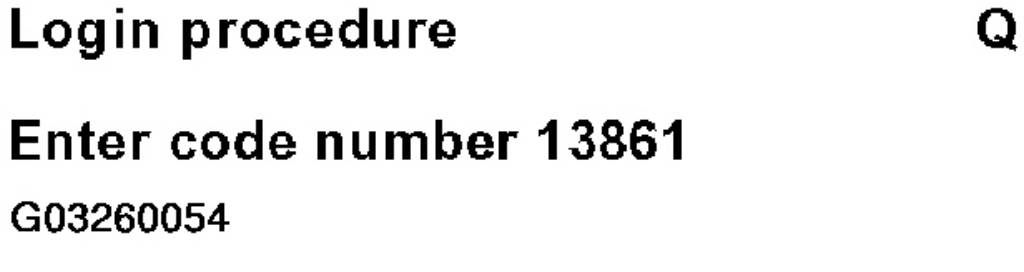

Fig. 6: Identifying VAG 1551/1552 Scan Tool Display (2 Of 3)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Press 0, 1 and 1 buttons to select Display Group 11
- Press Q button to enter input

  Read measuring value block 11 --> 840 RPM 938 mbar 978 mbar 92 %

Display will appear as shown

- Accelerate vehicle in 3rd gear from about 1500 RPM under Wide Open Throttle.
- Press VAG 1551 PRINT button at approx. 3000 RPM.

  Read measuring value block 11 --> 3090 RPM 1866 mbar 1917 mbar 62%

  Specification: 1700 to 2200 mbar (in display zone 3)

If specification not obtained:

- Perform Output Diagnostic Test Mode to activate Wastegate Bypass Regulator valve:

  See Function 03: Output Diagnostic Test Mode, Performing .

Display will appear as shown in **Fig. 7** .

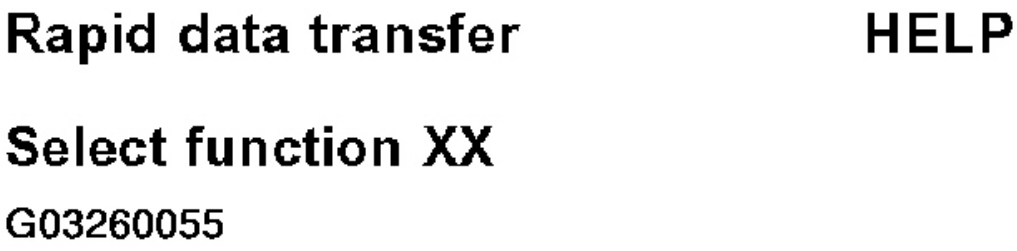

Fig. 7: Identifying VAG 1551/1552 Scan Tool Display (3 Of 3)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

NOTE: The valve must function and the charge air pressure control rod must move back and forth (at least 3 to 4 times), as long as there is a vacuum in the vacuum reservoir.

If rod moves but pressure specifications are not obtained

- Replace turbocharger.

If rod does not move because solenoid valve is not working:

- Check Wastegate Bypass Regulator valve -N75-. See **WASTEGATE BYPASS REGULATOR VALVE -N75-, CHECKING** .
- Check vacuum hoses. See **TURBOCHARGER, HOSE AND PIPE CONNECTIONS** .

If rod does not move but solenoid operates:

- Connect VAG 1390 vacuum pump to Wastegate Bypass Regulator valve and check rod for ease of movement.

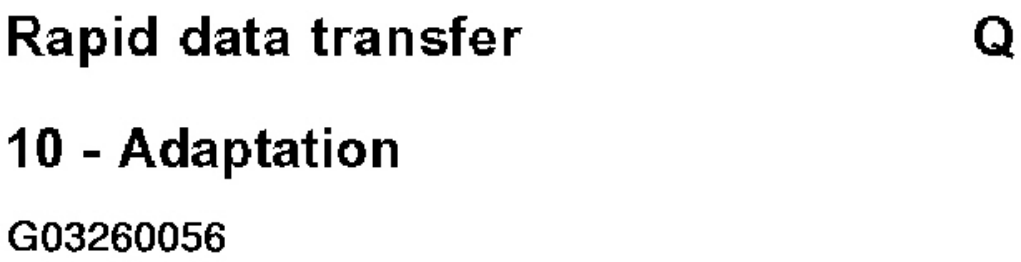

Fig. 8: Connecting Turbocharger To VAG 1390 Vacuum Pump
Courtesy of VOLKSWAGEN OF AMERICA, INC.

If rod does not move easily:

- Replace turbocharger assembly.

Wastegate Bypass Regulator valve -N75-, checking

- Switch ignition off.
- Disconnect Wastegate Bypass Regulator valve.
- Measure resistance between valve terminals.

Engine code ALH

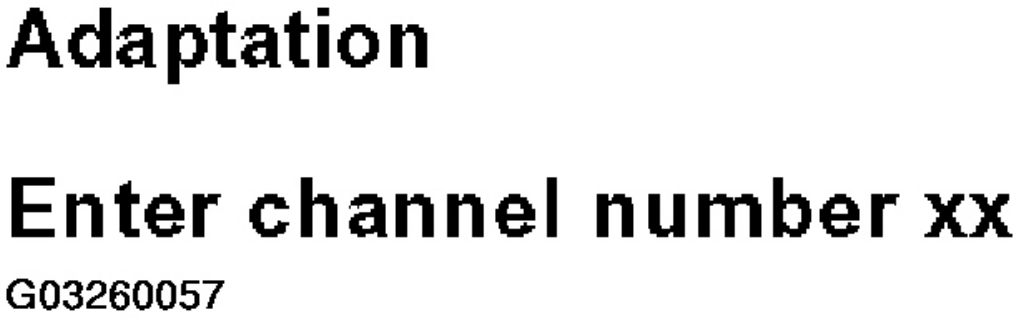

Fig. 9: Measuring Resistance Between Wastegate Bypass Regulator Valve Terminals
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Specification: 14 to 20 ohms

If specification not obtained:

- Replace Wastegate Bypass Regulator valve -N75-.

If specification obtained:

- Switch ignition on.
- Measure supply voltage at valve connector terminal 1 and at engine Ground.

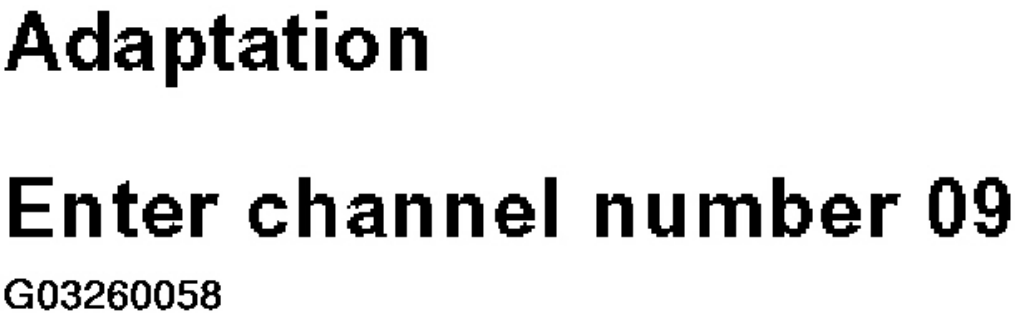

Fig. 10: Measuring Supply Voltage At Wastegate Bypass Regulator Valve Connector Terminal

Courtesy of VOLKSWAGEN OF AMERICA, INC.

Specification: approx. battery voltage

If specification not obtained:

- Switch ignition off.
- Connect test box VAG 1598/22 to ECM wiring harness.

Fig. 11: Connecting Test Box VAG 1598/22 To ECM Wiring Harness
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Check wiring for open circuit between Test Box and harness connector using Wiring diagram.

Up to MY 1999

- Terminal 1 + sockets 2 + 28
- Terminal 2 + socket 15

From MY 2000

- Terminal 1 + sockets 1 + 2
- Terminal 2 + socket 62

Wire resistance: 1.5 ohms maximum

- Check wires for short to one another, to vehicle Ground and to battery Plus.

  Specification: "INFINITE"ohms

If wiring OK

- Replace Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) -J248-:

  See Engine Control Module (ECM), Replacing .

EXHAUST SYSTEM, EMISSION CONTROLS

EXHAUST SYSTEM COMPONENTS, REMOVING AND INSTALLING

NOTE:

- **Removing and installing exhaust manifold. See TURBOCHARGER SYSTEM COMPONENTS, REMOVING AND INSTALLING .**
- **After working on the exhaust system make sure that the system is not under stress, and that it has sufficient clearance from the bodywork. If necessary, loosen double and single clamps and align muffler and exhaust pipe so that sufficient clearance is maintained to the bodywork and the support rings are evenly loaded.**
- **Replace self-locking nuts.**

Front exhaust pipe and catalyst with attachments

NOTE: The following list refers to items in Fig. 12 .

1. **from turbocharger**
2. **Gasket**
   - Replace
3. **25 N.m (18 ft lb)**
4. **Catalyst**
5. **to central muffler**
6. **Mounting**
7. **25 N.m (18 ft lb)**

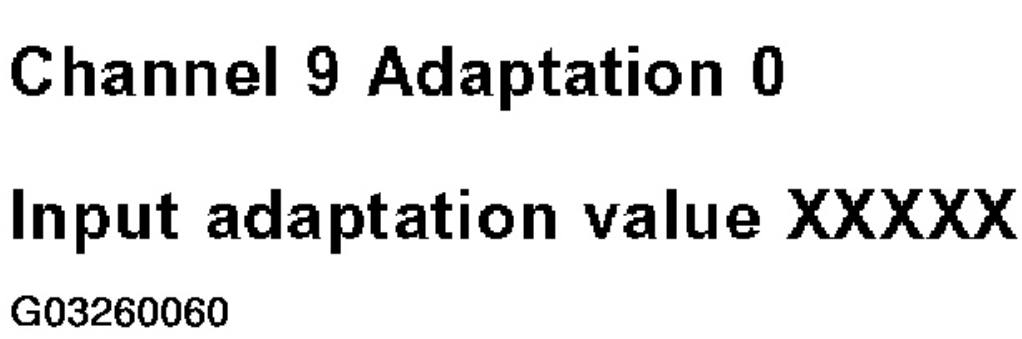

Fig. 12: Identifying Front Exhaust Pipe And Catalyst With Attachments
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Muffler with mountings

NOTE: The following list refers to items in Fig. 13 .

1. **40 N.m (30 ft lb)**
2. **from catalyst**
3. **Double clamp**
   - Note installation position. See **Double clamp installed position, checking**
4. **25 N.m (18 ft lb)**
5. **Mounting**
   - Note installation position. See **Installation position of mounting**
6. **Mounting**
   - With retaining ring
7. **Bracket**
8. **Mounting**
9. **Rear muffler**
   - Align rear muffler stress free. See **Rear muffler, aligning free of stress** .
10. **Separating point**
    - For repairs
    - Marked by three impressions on circumference of exhaust pipe
    - In production, exhaust pipe and rear mufflers are installed as a single component. For repairs, the exhaust pipe and rear muffler are supplied individually with a double clamp to allow connecting together.
    - Cut through connecting pipe at right angle to separation point. See **Exhaust pipe, separation**

point .

11. **20 N.m (15 ft lb)**
12. **Tunnel bridge**

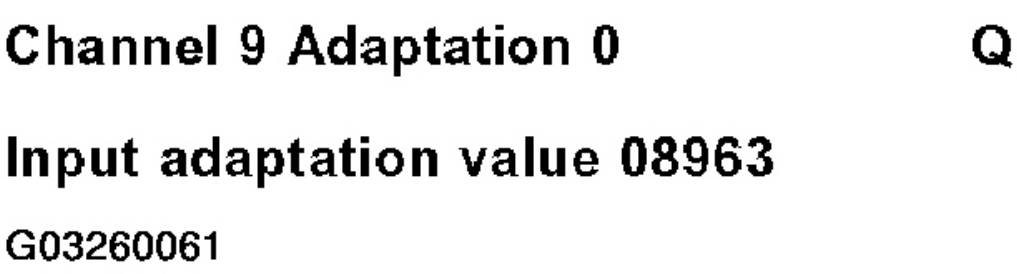

Fig. 13: Identifying Muffler With Mountings
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Double clamp installed position, checking

Fig. 14: Identifying Double Clamp Installed Position
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Position double clamp approx. 5 mm from mark A (arrow -1-).

NOTE: Mark -A- is valid for vehicles with either manual or automatic transmissions.

Installation position of mounting

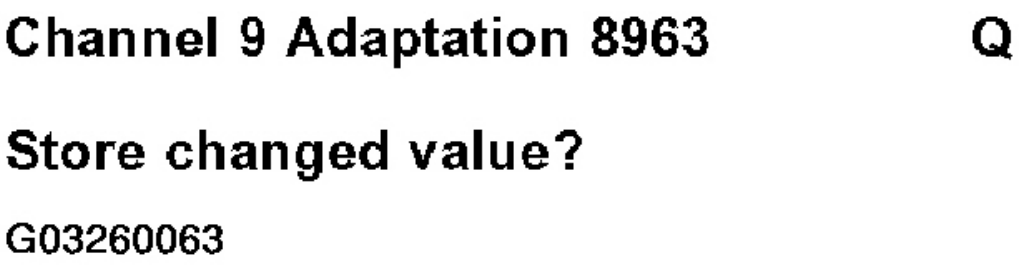

Fig. 15: Identifying Installation Position Of Mounting
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Angled side on foot of mounting (arrow) points forward.

Exhaust pipe, separation point

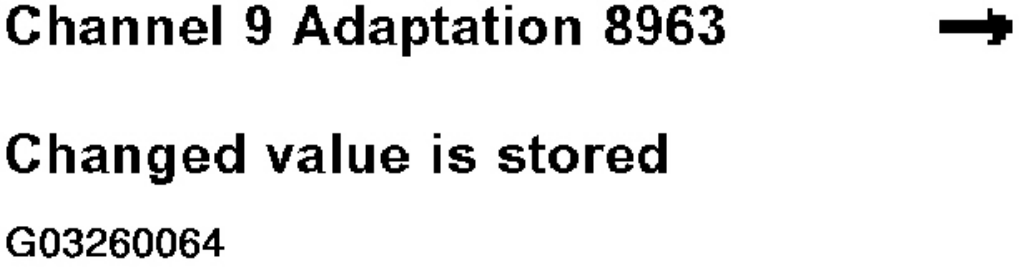

Fig. 16: Identifying Exhaust Pipe, Separation Point
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Cut exhaust pipe at right angles to separating point (arrow -2-).
- Position repair clamp -4- when installing (arrows -1- and -3-)
  - Tightening torque 40 N.m (30 ft lb)

Rear muffler, aligning free of stress

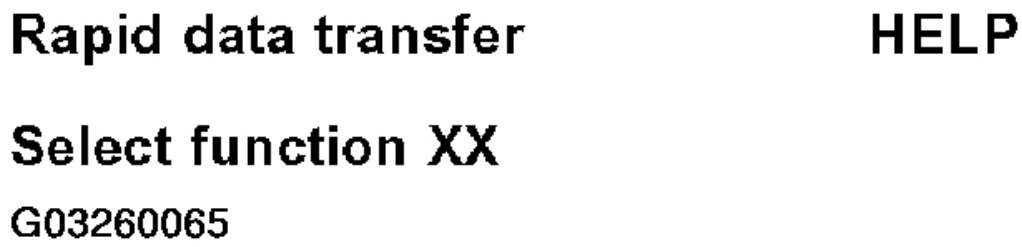

Fig. 17: Rear Muffler, Aligning Free Stress
Courtesy of VOLKSWAGEN OF AMERICA, INC.

NOTE: Mounting pins on exhaust pipe must run parallel with tunnel bridge (dimension -x- on left and right = the same).

EXHAUST GAS RECIRCULATION (EGR) SYSTEM, OVERVIEW

NOTE:

- **The function/control of the Exhaust Gas Recirculation (EGR) system is managed by the Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) -J248- via the EGR Vacuum Regulator solenoid valve -N18-.**
- **The cone shaped plunger in the mechanical EGR valve ensures that various cross sectional openings are possible at different plunger heights.**
- **Every possible valve position is provided via pulsed control.**
- **Replace self-locking nuts.**

Exhaust Gas Recirculation (EGR) system components, removing and installing

NOTE: The following list refers to items in Fig. 18 .

1. **Intake manifold**
2. **O-ring**
   - Replace
3. **Throttle valve**
   - With EGR valve and control flap
4. **Exhaust Gas Recirculation (EGR) valve**
   - Component of intake support
   - Can only be replaced with intake support assembly
   - Checking: See **EXHAUST GAS RECIRCULATION (EGR) VALVE, CHECKING** .

- Control, checking:

See Function 03: Output Diagnostic Test Mode, Performing .

5. **10 N.m (7 ft lb)**
6. **from Air Cleaner**
7. **Gasket**
   - Replace
8. **25 N.m (18 ft lb)**
9. **Connecting pipe**
   - EGR cooler to intake support
10. **Connecting pipe**
    - EGR cooler to exhaust elbow
11. **Exhaust manifold**
12. **25 N.m (18 ft lb)**
13. **to heat exchanger**
14. **EGR cooler**
15. **Connection**
    - Heater
16. **to Coolant expansion tank**

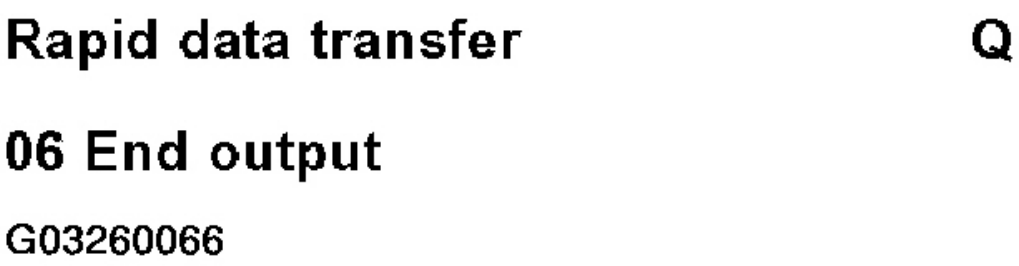

Fig. 18: Exploded View Of Exhaust Gas Recirculation (EGR) System Components
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Vacuum hose connections, diagram

NOTE: The following list refers to items in Fig. 19 .

1. **EGR valve**

2. **EGR Vacuum Regulator solenoid valve -N18-**
3. **Check valve**
4. **Brake servo**
5. **Air Cleaner**
6. **Vacuum pump**

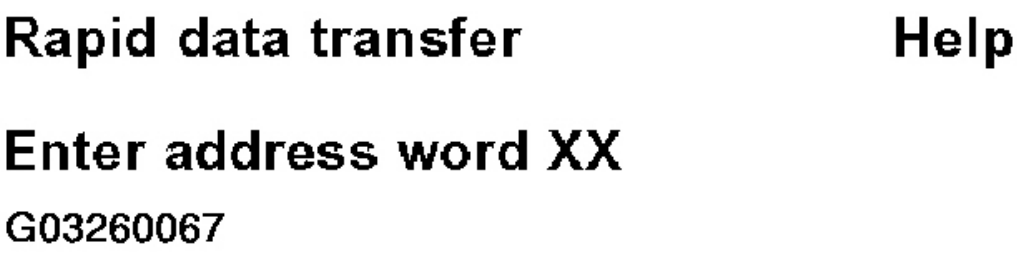

Fig. 19: Identifying Vacuum Hose Connections
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Exhaust Gas Recirculation (EGR) valve, checking

Special tools and equipment

- VAG 1390 Hand vacuum pump

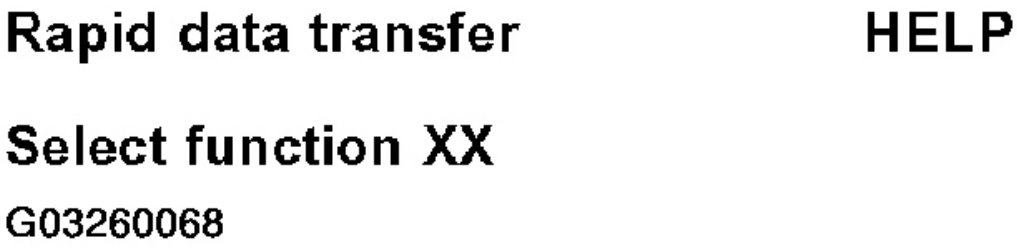

Fig. 20: Identifying VAG 1390 Hand Vacuum Pump
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Test sequence

- Remove engine cover.
- Disconnect pipe between Charge Air cooler and intake manifold at intake manifold.
- Disconnect vacuum hose from EGR valve.
- Connect VAG 1390 hand vacuum pump to EGR valve.
- Operate pump and observe membrane rod.

  Membrane rod must move in direction of arrow.

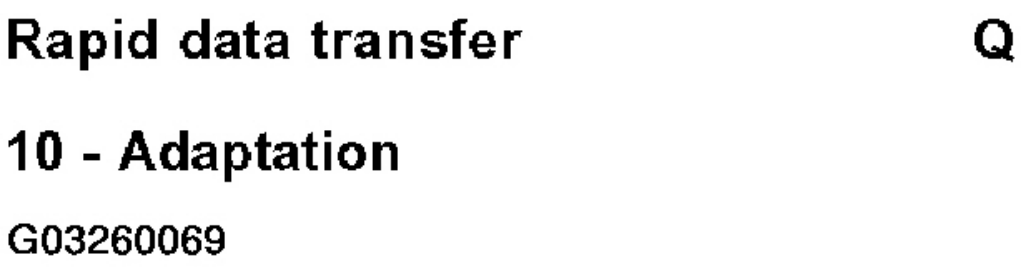

Fig. 21: Locating Hand Vacuum Pump Membrane Rod
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Disconnect hand vacuum pump hose from EGR valve.

  Membrane rod must move back against direction of arrow to its original position.

Exhaust Gas Recirculation (EGR), checking

Special tools and equipment

- Fluke 83 multimeter
- VW 1594 Adaptor kit
- VAG 1598/22 Test Box
- VAG 1551/1552 Scan Tool with VAG 1551/3 adaptor cable
- Wiring diagram

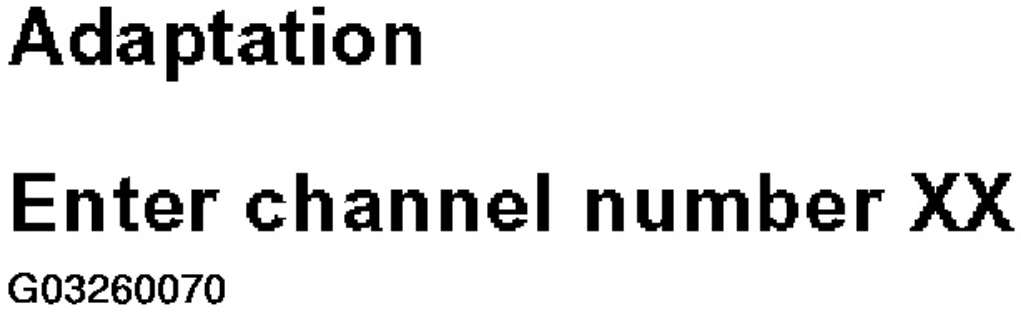

Fig. 22: Identifying Special Tools And Equipment
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Test sequence

NOTE: The EGR return function is checked via Function 04 (Basic Setting). Through this procedure the valve for EGR is metered every 10 seconds, so that in measured value block 003 the extreme values for the EGR (air mass sensor) in display field 3 can be read.

- Connect VAG 1551/1552 Scan Tool:

  See VAG1551/1552 Scan Tool, Connecting .

- Start engine and let idle.
- Press 0 and 1 buttons to select Address word 01 "Engine electronics":

  See DTC Memory, Checking .

Indicated on display

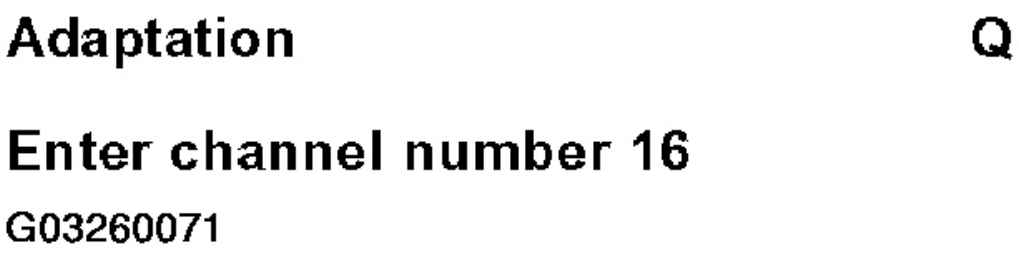

Fig. 23: Identifying Special Tools Display (1 Of 3)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Press 0 and 4 buttons to select Function 04: "Basic setting".
- Press Q button to enter input.

Indicated on display

Fig. 24: Identifying Special Tools Display (2 Of 3)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Press 0, 0 and 3 buttons to select "Display group 3".
- Press Q button to enter input.

Indicated on display: (1 to 4 - Display zones)

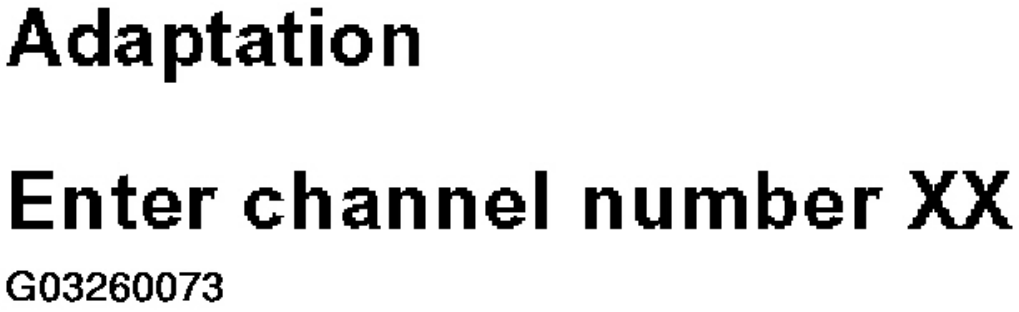

Fig. 25: Identifying Special Tools Display (3 Of 3)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Display in field 2 must fluctuate every 10 seconds between EGR active or EGR inactive (n.aktiv).

Displays in display zones 3 and 4 must fluctuate within following control range:

NOTE: If a constant value of 550 mg/H is indicated in display zone 3, check Mass Air Flow sensor.

See Mass Air Flow (MAF) Sensor -G70-, Checking .

If EGR NOT active:

Specification display zone 3: 420 to 560 mg/stroke

Specification display zone 4: 0 to 5%

If EGR active:

Specification display zone 3: 170 to 340 mg/stroke

Specification display zone 4: 95 to 100%

If specifications not obtained:

- Check mechanical EGR valve. See **EXHAUST GAS RECIRCULATION (EGR) VALVE, CHECKING** .
- Check vacuum hoses. See **VACUUM HOSE CONNECTIONS, DIAGRAM** .
- Check EGR Vacuum Regulator solenoid valve as follows:

- Press --> button.
- Press 0 and 6 buttons to select Function 06: "End transfer"
- Press Q button to enter input.
- Switch ignition off.
- Disconnect harness connector -1- from EGR valve -2-.

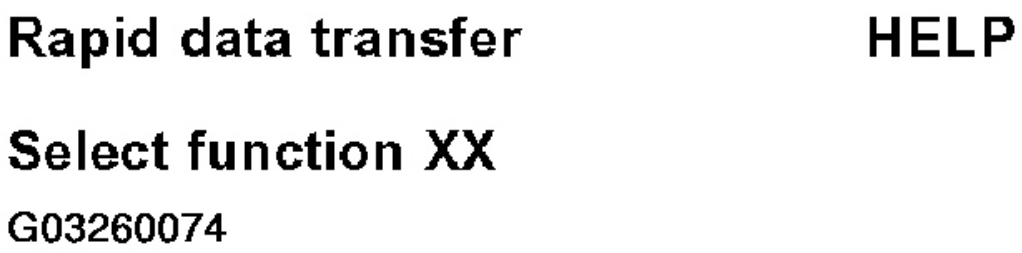

Fig. 26: Locating Harness Connector
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Measure resistance across valve.

  Specification: 14 to 20 ohms

If specification not obtained:

- Replace EGR Vacuum Regulator solenoid valve -N18-.

NOTE: At room temperature, resistance lies in the lower tolerance range and in the upper range at operating temperature.

If specification obtained:

- Switch ignition on.
- Measure supply voltage at valve connector terminal 1 and at engine Ground.

Fig. 27: Identifying EGr Vacuum Regulator Solenoid Valve Connector Terminal
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Specification: approx. battery voltage

If specification not obtained:

- Switch ignition off.
- Connect Test Box VAG 1598/22 to ECM wiring harness.

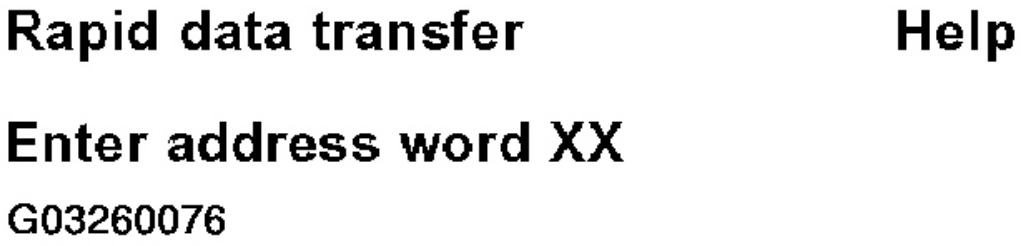

Fig. 28: Connecting Test Box VAG 1598/22 To ECM Wiring Harness
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Check wiring for open circuit between Test Box and harness connector using wiring diagram.

Up to MY 1999

- Socket 1 + terminals 2 + 28
- Socket 2 + terminal 29

From MY 2000

- Socket 1 + terminals 1 + 2
- Socket 2 + terminal 61

Wire resistance: 1.5 ohms maximum

- Check wires for short to one another, to vehicle Ground and to battery Positive (+).

  Specification: "INFINITE" ohms

If wiring OK:

- Replace Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) -J248:

  See Engine Control Module (ECM), Replacing .